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Pat Quinn, Governor
Marc Miller, Director

March 27, 2012

Ms. Kristine Donarski, Zoning Officer
Bureau County
700 South Main St.
Princeton, IL 61356

RE: **Green River Wind LLC, Bureau County**
Endangered Species Consultation Program
EcoCAT Database Review #1111190

Dear Ms. Donarski:

The Department has received this project for consultation, pursuant to the *Illinois Endangered Species Protection Act* [520 ILCS 10/11], the *Illinois Natural Areas Preservation Act* [525 ILCS 30/17], and Title 17 *Illinois Administrative Code* Part 1075.

Mainstream Power USA/Green River Wind proposes a commercial wind energy generation project in northwestern Bureau County, comprised of approximately 19 wind turbines. Turbines in Bureau County will supply power to a substation located in Whiteside County. Collection power lines will be located underground, and each turbine will be served by an access road. Soils in the project area consist largely of sandy and friable loamy soils, most of which are tilled, though some remain in pasture or open woodlands. The project area is drained by the Green River and tributaries of the Walnut Special Ditch.

It is the biological opinion of the Department the proposed action is likely to adversely modify the essential habitat of the state-listed **Ornate Box Turtle**, **Plains Hognose Snake**, **Weed Shiner**, and **Starhead Topminnow**, and may adversely modify habitat for the state-listed **Regal Fritillary Butterfly**, **Loggerhead Shrike**, **Short-eared Owl**, and **Northern Harrier**. The Department recommends the applicant seek an Incidental Take Authorization from the Department for the Ornate Box Turtle and the Plains Hognose Snake. The Department's opinions are further explained below, with more detailed recommendations where applicable.

Ornate Box Turtle, *Terrapene ornata ornata*. The Ornate Box Turtle was listed by Illinois as threatened in October 2009. Many populations have been adversely affected by habitat conversion for agriculture and over-collection for the pet trade. Because of their commercial value, poaching may be a serious problem in some areas.

This species has not been recently reported from Bureau County, though historic records exist, but extant populations remain in adjacent Lee and Whiteside Counties. Being a small (<six inches) terrestrial turtle which spends significant time underground, this animal can easily escape notice.

People may be more familiar with the closely-related Eastern Box Turtle, *Terrapene carolina*, which may also be found in Bureau County but is not listed. The Eastern Box Turtle prefers more wooded habitats and its shell markings are quite different; reference to photographs makes identification easy.

Recent experiments with radio-tagged Ornate Box Turtles in Illinois have shown that, even where the species is abundant and active on the surface, the probability of human searchers finding even one specimen during a survey is less than 3%; numerous unsuccessful surveys would be needed to confidently and reliably conclude suitable habitat is unoccupied by this species. (Using specially-trained "turtle dogs" increases detection success by more than 300%, but many turtles remain undetected.)

Significant acreages of suitable soils and fragmented habitat exist within the Bureau County footprint of this project. Consequently, the lack of reported casual observations in this portion of Bureau County over the last two years is not a sufficient basis to conclude the species is absent from the project area. Although Mainstream has carefully analyzed the locations of available primary habitat, no on-the-ground surveys for this species were attempted.

A number of life history characteristics increase the vulnerability of this species to disturbances during both construction and operation of a wind farm.

From late September through mid-April, the Ornate Box Turtle hibernates (more properly, as a reptile, it brumates) in burrows as deep as three feet underground. Such burrows are far from obvious to humans, so that for more than six months of the year this species is not subject to observation. Construction activities in occupied habitat during this period run the risk of killing or injuring turtles during excavation of power line routes and turbine foundations, or of sealing such burrows when constructing access roads. The only practical means of avoiding such outcomes is to perform such activities during the turtle's active periods.

However, this species continues to spend significant portions of each day underground, either in burrows or shallow excavations near the surface called "forms." (During their first two or three years, hatchlings spend virtually all of their time underground.) Thus, even during the "active" portion of the Turtle's annual cycle, excavation activities in occupied habitat run a high risk of injuring or killing unobserved animals.

Moreover, this species demonstrates extremely high fidelity to brumation sites, often returning to within a yard of where it spent the winter the prior year. If a brumation site is located where a turbine foundation or access road is installed, it is unclear how a turtle will respond. There is always the chance that an alternate brumation site will not assure survival through the winter.

It has been suggested that Turtles can simply be moved out of the way. In the first place, such handling constitutes a "take" which requires a permit from the Department. But two other factors work against such a method. (1) Home ranges for this species are very small, consisting of only a few acres, though home ranges often overlap, and (2) this species is highly philopatric, meaning it has an extremely strong attachment to its home range, and will return to it if removed, or die trying. Thus, moving a Turtle "out of harm's way" may result in removing the animal from its home range, exposing it to various threats during its efforts to return. If its return is successful, it will be in harm's way again, perhaps repeatedly.

Because this species finds movement through dense vegetation difficult, it prefers areas where vegetation is sparse or absent. Roads satisfy this desire for easy movement (as do tilled fields), and also provide basking areas where temperatures may rise more quickly in the morning or during cooler weather. Most of the Department's observation records for this species are adjacent to roads or are recorded as road-kills. Further, a study of nesting radio-tagged females on an Illinois federal Wildlife Refuge found that 50% of selected nest sites were directly adjacent to the single road which crossed the study area; this is clearly not a random result. Therefore, increased levels of traffic associated with construction and the construction of thousands of feet of new roads pose a significant threat of losses to any existing population. Several of the planned turbines and their access roads appear to be planned for locations within or adjacent to suitable habitat for this species, especially in Section 11, north of 2850 North Avenue.

The operation of wind turbines near occupied habitat may constitute an on-going "take" of this species in terms of harassment or interference with normal activities.

Shadow-flicker may pose a serious long-term threat. Theoretically, at dawn or sunset over flat ground, shadows may be cast more than a mile. After accounting for diffusion and diffraction through the atmosphere under varying conditions, meaningful shadows may extend over half a mile, but the intensity of shadow needed to produce an effect on wildlife is unknown. But, it can be seen that shadows will impact a very large fraction of the ground in the vicinity of turbines for much of any given day. Shadows at the extremes may last for mere minutes, while other areas closer to the machines are affected for hours at a time. If turbines are spaced together closely enough along roughly the same latitude, the same ground may be affected in both the morning and the evening by shadows cast by different turbines. (At this latitude, the area affected by shadows at some time of the year is shaped something like a bow-tie; there is never a shadow on a significant area centered due-south of a turbine.)

The Ornate Box Turtle's daily pattern consists of an early morning emergence, followed by basking to raise its body temperature. When a body temperature suitable for activity is achieved, it forages across its range for several hours, feeding on worms, insects, and small mammals, until temperatures become too high, when it seeks shelter beneath vegetation, in a burrow, or in a "form." It remains inactive until late afternoon or early evening, when temperatures allow a second foraging period. The Ornate Box Turtle retreats to a burrow before darkness falls, with the exception of females during nesting periods (late May and June), when eggs are laid at night.

Shadow flicker may seriously interfere with basking and foraging. Among this species' predators are crows and hawks, and it has been established this species is sensitive to movement

within its range of vision, which causes it to "freeze" and adopt a surveillance posture called "standing rest." Shadow flicker may mimic the movement of both aerial and terrestrial predators which stimulate the "standing rest" response, though this has not been investigated with respect to wind turbines. If this does occur, it would constitute a prohibited taking (harassment) within the meaning of the law. Coupled with the fact that entire home ranges, being small, may be subject to shadow flicker, Turtles may be stressed and underfed, leading to breeding failures and decreased survival.

Turbine-generated noise is usually considered in the context of human impacts, but it does have the potential to interfere with animal communication and survival. Sound wave intensity decreases according to an inverse square law, so that at twice the distance it has one-fourth the intensity. Going the other way, at half the distance it is four times louder. A common benchmark for wind turbines is a sound level equivalent to normal conversation at 1,000 feet.

A circle with a 1,000-foot radius encompasses covers about 72 acres, throughout which turbine noise is likely to equal or exceed normal conversation. The overlapping home ranges of dozens of Ornate Box Turtles could be contained within an area of this size. The Ornate Box Turtle's mating ritual includes exchanges of sounds variously described as "vigorous aspirations" or "sibilant grunts" which may contain infra-sonic or ultra-sonic components not audible to humans. Turbine noise may be sufficient to mask these communications, whose importance to the mating ritual is not well-understood. Thus, turbine noise has the potential to decrease reproductive success.

Turbine noise may also be sufficient to mask the approach of predators, though the range of such an effect is unknown, and may vary among turbine models. Predators include coyotes, badgers, skunks, raccoons, opossums, and other mammals (as well as the also-state-listed Plains Hognose Snake, an egg-predator). The Ornate Box Turtle is most vulnerable when younger: it cannot close its shell completely until about four years old, and the shell does not completely harden until about ten years of age. Losses to predation decrease greatly with advancing age and experience. Turbine noise may render predator detection and evasion more difficult, decreasing survival.

Turbine vibrations may pose another risk factor. Many reptiles are very sensitive to vibrations transmitted through the ground, as are earthworms and other soil organisms on which Turtles feed. Vibrations may affect the supply of prey and impose additional stress, but if animals become habituated to them, they may remain oblivious to threats they would otherwise detect through this means. It might be possible that vibrations (produced by the wind even when turbines are not operating) might interfere with their winter brumation, which could increase the main cause of natural mortality for this species.

Underground collection power lines may affect Ornate Box Turtles through thermal radiation. All electrical conductors provide resistance to current, which in turn produces heat. In the air, heat is easily dissipated but, underground, heat can only be transferred to surrounding soils, which will increase the temperature of those soils above normal, though the number of degrees and the distance from the conductor these effects may extend will vary with soil characteristics.

The gender of Ornate Box Turtle hatchlings is determined by the temperature in the nest. While the exact temperature of sexual differentiation in this species has not been determined, it is known that eggs incubated at 84°F will produce 100% females. Nests are typically placed at depths no greater than 10-14 inches, but the Department has no data on the degree of heating produced in underground collection cables, which are normally placed at depths of about four feet, and so is unable to fully evaluate potential impacts to populations from this cause.

The second way underground power lines may affect this species is during brumation. Turtles must lower their metabolism to levels which will allow them to survive the winter based on their reserves of fat, and their metabolic rate is determined by body temperature. As noted, Turtles return to nearly the exact spot used the prior year for brumation. Power lines through or beneath such locations could prevent Turtles from achieving the body temperature needed for survival.

The potential adverse effects of shadow-flicker, noise, vibration, and thermal radiation on the Ornate Box Turtle have not been reported at this point in time, but the Department is unaware of any effort by biologists or others to investigate the significance of such factors for this species. Such effects are plausible and should be considered by developers and government officials.

The developer has proposed a 100-foot setback from suitable habitat on leased parcels for construction activities in order to protect Ornate Box Turtles which may be present. But the Department is unaware of any biological or ecological basis supporting a 100-foot setback for construction activities. There is no evidence suggesting the Ornate Box Turtle does not make forays extending beyond 100 feet from areas humans may perceive to be "suitable habitat," and, as described above, important adverse effects from shadows, noise, and vibration may extend far beyond areas directly disturbed by construction.

Recommendation #1: The County should consider a requirement for the developer to obtain an Incidental Take Authorization from the Department for the Ornate Box Turtle.

The following recommendations will be most important if an Incidental Take Authorization is not obtained; any requirements imposed should allow pre-emption by an IDNR permit addressing the issue.

Recommendation #2: The County should consider a requirement that all contractors and employees working on the project should be trained to recognize the Ornate Box Turtle, to understand its significance to the project and the public, and be instructed how to respond to an observation or encounter with this species.

Recommendation #3: The County should consider a requirement for a pre-construction survey for the Ornate Box Turtle in suitable habitat within 0.6 miles of proposed turbine locations, performed using suitably-trained dogs, during May and June when this species is most active on the surface. No disturbance related to the project should be allowed in any habitat demonstrated to be occupied by the Ornate Box Turtle unless an Incidental Take Authorization has been obtained from the IDNR.

Recommendation #4: The County should consider a requirement, if Ornate Box Turtles are found within the project footprint, for the developer to conduct radio-telemetry studies (after securing the required permits from IDNR) of their movements and responses to turbines, collection power lines, and access roads with the goal of determining and reporting the degree of any adverse effects plausibly caused by construction and operation of the wind farm.

Recommendation #5: Where the Ornate Box Turtle is determined to be present, the County should consider a requirement for the developer to establish and fund a predator control program to reduce predation of nests and turtles, a similar program to combat poaching of the Ornate Box Turtle, and an incentives program for private land owners to promote conservation of this species.

Recommendation #6: If the Ornate Box Turtle is determined to be present, the County should consider posting signs along public roads within the project footprint alerting motorists to the risk of killing or injuring this species. If and when this species is documented crossing a public road, a "Turtle Crossing" sign should be considered 200 hundred feet on either side of the crossing point.

Recommendation #7: The County should consider a requirement for a periodic assessment of Ornate Box Turtle populations, at least once per decade, with a report to County officials and the IDNR of apparent population trends and possible explanations for the results.

Plains Hognose Snake, *Heterodon nasicus nasicus*. Formerly known as the Western Hognose Snake, this stout-bellied snake is also an inhabitant of sand prairies and similar ecosystems, and is often found in the same areas as the Ornate Box Turtle, of which it is a natural enemy (as a predator of turtle eggs), although its primary prey consists of toads, lizards, ground-nesting birds, other snakes, and small mammals.

It can be easily confused with its close relative, the **Eastern Hognose Snake**, *Heterodon platirhinos*, and the ranges of the two species often overlap, though the Eastern Hognose is more often found in wooded areas than the Plains Hognose which, as its name implies, prefers more open habitats. Both species can be found in and near the project footprint. They are most reliably distinguished by the coloration of the underside of the tail: that of the Eastern Hognose is always much lighter than the rest of the belly, while that of the Plains Hognose is the same as the rest of the belly.

The name "Hognose" is descriptive of the upturned scales on the snake's snout. Unlike many snakes these species can burrow in loose soils due to these specialized scales. Though they can actively hunt, they often bury themselves with only their eyes exposed and lie in wait to ambush prey. Like the Ornate Box Turtle, this species spends much of its time underground for purposes of thermo-regulation and is therefore difficult to observe. Many Department records are road-kills.

The Hognose snakes are also famous for their defensive behavior. A threatened snake will flatten its body, hiss, feign strikes, and defecate. If the aggressor is not deterred, the snake will

roll onto its back and pretend to be dead; if placed back on its belly, it will roll over again and repeat the display.

Because of its docile nature, this non-venomous snake is popular in the pet trade, and many populations have suffered from over-collecting. Poaching and persecution continue to be serious problems. These are aggravated by losses of habitat to tilled agriculture.

The Hognose has many natural enemies: other snakes, hawks and owls, and mammals such as coyotes, foxes, raccoons, skunks, and opossums. An egg-layer, its shallow nests are vulnerable to predation; neonates are about six inches long, but adults seldom reach 30 inches. Females cannot reproduce until their second year. Home ranges tend to be small, consisting of just a few acres, but individual territories are not exclusive and a few acres may hold significant numbers of snakes.

The Plains Hognose Snake may be vulnerable to many of the same characteristics of wind farms as the Ornate Box Turtle. Unfortunately, where both wind turbines and Hognose Snakes are common, as in Texas, it appears nobody has investigated interactions between this technology and this animal.

Obviously, construction can destroy and fragment habitat, and risks killing the snake by crushing it with vehicles or through active persecution or collection by construction workers. Shadow-flicker, as discussed previously, may interfere with basking and feeding through stimulating predator-evasion responses. While prey-detection may be primarily by sight or scent, ground vibrations from turbines might interfere with successful detection and feeding. Thermal radiation effects from underground collection power lines may interfere with brumation, but are less likely to affect reproduction, since the nests of the Hognose are much closer to the surface than those of the Ornate Box Turtle.

The Plains Hognose Snake is as cryptic and as difficult to detect as the Ornate Box Turtle, so that "visual encounter surveys" are an unreliable technique for assessing the presence or absence of this species, or the size of a population. Nor is the occasional road-kill a good barometer of numbers. As with the Ornate Box Turtle, trained dogs are likely to have a higher detection success rate.

The Plains Hognose Snake has not been recently reported from Bureau County, but extant populations are known to exist within the project footprint in Whiteside County and Lee County. In the Department's opinion, there is a strong possibility this species is present in remaining fragmented habitats in northern Bureau County.

Recommendation #8: The County should consider a requirement for the developer to obtain an Incidental Take Authorization from the Department for the Plains Hognose Snake.

The following recommendations will be most important if an Incidental Take Authorization is not obtained; any requirements imposed should allow pre-emption by an IDNR permit addressing the issue.

Recommendation #9: The County should consider a requirement that all contractors and employees working on the project should be trained to recognize the Plains Hognose Snake, to understand its significance to the project and the public, and be instructed how to respond to an observation or encounter with this species.

Recommendation #10: The County should consider a requirement for a pre-construction survey for the Plains Hognose Snake in suitable habitat within 0.6 miles of proposed turbine locations, performed using suitably-trained dogs, during May and June. No disturbance related to the project should be allowed in any habitat demonstrated to be occupied by the Plains Hognose Snake unless an Incidental Take Authorization has been obtained from the IDNR.

Recommendation #11: The County should consider a requirement, if Plains Hognose Snakes are found within the project footprint, for the developer to conduct radio-telemetry studies (after securing the required permits from IDNR) of their movements and responses to turbines, collection power lines, and access roads with the goal of determining and reporting the degree of any adverse effects plausibly caused by construction and operation of the wind farm.

Recommendation #12: Where the Plains Hognose Snake is determined to be present, the County should consider a requirement for the developer to establish and fund a predator control program to reduce predation of nests and snakes, a similar program to combat poaching of the Plains Hognose Snake, and an incentives program for private land owners to promote conservation of this species.

Recommendation #13: If the Plains Hognose Snake is determined to be present, the County should consider posting signs along public roads within the project footprint alerting motorists to the risk of killing or injuring this species. If and when this species is documented crossing a public road, a "Snake Crossing" sign should be considered 200 hundred feet on either side of the crossing point.

Recommendation #14: The County should consider a requirement for a periodic assessment of Plains Hognose Snake populations, at least once per decade, with a report to County officials and the IDNR of apparent population trends and possible explanations for the results.

Starhead Topminnow, *Fundulus dispar*, and Weed Shiner, *Notropis texanus*. These small fishes have been recorded recently from the Walnut Special Ditch, which drains most of the proposed project footprint in Bureau County. The remainder of the project area is drained by other tributaries of the Green River, as well as the Green River, itself. The Starhead Topminnow is listed as "threatened" while the Weed Shiner is listed as "endangered." Habitat for both species is limited to streams and lakes in the sand regions of Illinois. Though their habitat is relatively rare, each species may be abundant in appropriate habitat. Nevertheless, it remains unlawful to "take" these fish or their eggs, despite local abundance. It is likely these species are present in all streams and floodplain pools within the project footprint.

These species are often found together. They prefer shallow, weedy, slow-moving waters over sandy bottoms. They require waters only a few inches in depth, and can sometimes be found in roadside ditches most people would not consider streams. Both species may move upstream in

spring and downstream later in the year. They are tolerant of warmer waters, but prefer cooler waters associated with agricultural drain tile discharges.

Like other species of the *Notropis* genus, Weed Shiner eggs are scattered on the bottom but, as with other *Fundulus* species, those of the Starhead Topminnow are attached individually and in small clusters to rooted aquatic plants. Starheads spawn in late June through July, but there is considerable evidence the Weed Shiner may spawn throughout all seasons except winter, though the greater part of egg-laying may occur in May and June.

These species feed on plankton, small crustaceans, and aquatic insects. Given their small size, these species are, themselves, prey for numerous other fish, salamanders, snakes, turtles, birds, and mammals. Schooling is a defense mechanism and they may retreat into plant beds or to the bottom to evade predators.

The Department is unaware of any scientific research regarding the effects of wind turbines on freshwater fishes; studies of marine species have shown that some species are strongly affected while others are not affected at all.

It is well-known that wind turbine construction activities damage or destroy agricultural drain tiles, and this is likely a major way in which aquatic habitat may be affected by changing its thermal regime. Ground water discharged from drain tiles tends to maintain steady temperatures in the low-to-mid-fifty-degree range throughout the year, moderating seasonal and daily temperature extremes in receiving streams and surface drains. The smaller the stream in terms of flow volume, the slower the flow velocity, and the shallower the cross-channel geometry, the greater the thermal effects of receiving or not receiving tile discharges. Many species of benthic invertebrates, macro-invertebrates, and fishes are intolerant of warmer temperatures. For example, water temperatures of 77° F are fatal to the Mudpuppy Salamander.

Sandy soils are generally well-drained unless low-lying, but where drainage tiles have been installed, their disruption can have significant localized effects on aquatic habitat. Consequently, where such habitat is occupied by listed species, it will be important to avoid such damages as much as possible and to promptly repair or restore those tile drains which are damaged or destroyed.

It is sometimes necessary to cross a surface drain with a power line or with vehicles. Directional boring has become a common method of avoiding direct impacts to stream channels, and where soils have sufficient structural strength to avoid "frac-outs" of the drilling mud, this method is preferred.

Trenching through a stream channel, whether "wet" or "dry" can pose the risk of prohibited incidental taking of listed fishes in the stream (as well as requiring additional permits from the Army Corps of Engineers and the IEPA).

Low-water crossings for vehicles can be temporary or permanent, but also pose the risk of prohibited incidental taking of listed fishes in the stream. Crossings also have implications for altering stream geometry downstream which should be carefully considered, but permanent

crossings can have some beneficial impacts for aquatic organisms so long as they do not pose barriers to upstream movement. They can provide riffles and pools which improve oxygenation of the water and they diversify the habitat.

Many marine fishes have demonstrated a sensitivity to electro-magnetic fields (EMF) produced by underwater cables. While electrical fields can be effectively blocked by soils, EMF is not. The strength of EMF is inversely proportional to the distance from the conductor. Thus, the EMF four feet above an underground power line is five times stronger than the EMF from a power line twenty feet overhead. In a confined stream channel environment, if a fish or other aquatic organism is sensitive to EMF, the possibility exists the installation of a power line beneath the stream may erect a barrier to movement.

Safety standards for EMF are generally intended to avoid gross physical injury, and thus are set quite high; they are not intended to address the potential for behavioral modification (avoidance). In addition, there is abundant evidence that EMF adversely affects intra-cellular biological activity, notably RNA and DNA replication. To the Department's knowledge, such effects have not been studied in relation to wildlife and wind farm construction or operation in North America.

Two other potential vectors for adverse effects are vibration and shadow-flicker. Any fisherman can testify to the importance of avoiding noise. Nearly all fishes possess a sensitive "lateral line" of scales down each side used to detect very subtle changes in water pressure. This aids in navigating habitats, in detecting prey, in avoiding predators, and in reproduction. It sometimes results in bizarre behavior, such as the well-known airborne antics of Silver Carp in response to boat engine noise.

Scientific instruments can detect the vibrations from individual turbines from at least as far as six miles, as demonstrated by a study in Scotland. How strong a vibration must be to alter the behavior of a fish is not known, and likely varies among species, but it is plausible that turbines proposed for this project may affect the behavior of fishes and other organisms in streams within and adjacent to the project area.

Vibrational effects may vary from one point to another. When multiple noise sources are operative, at the points where sound waves intersect the strength (amplitude) of the wave may be cancelled or amplified. Thus, points may exist where any effect is entirely absent while at others it is much stronger than elsewhere. Complicating any evaluation is the fact that such points will change location with changes in wind speed, which will likely alter the frequency of emanations from the turbine.

Vibrations may affect fish behavior directly, by causing them to avoid/evacuate certain areas or elevating stress levels, or indirectly, by altering the behavior or distribution of prey or predators.

Shadow-flicker may stimulate a predator-avoidance response or considerably complicate feeding for those species which feed mainly by sight.

Recommendation #15: The County should consider a requirement for standard fish surveys of any waters where direct disturbance of the channel or bed is proposed and prohibit such disturbance where the Starhead Topminnow and Weed Shiner are present, unless an Incidental Take Authorization is first obtained from the Department.

Recommendation #16: The County should consider a requirement to promptly repair or replace any damaged or destroyed drain tiles in order to maintain the receiving stream's normal thermal regime as much as possible.

Recommendation #17: The County should consider a requirement to study the responses of fish and other aquatic organisms to shadow-flicker and vibration associated with wind turbines. Studies could include mapping the intensities of vibrations at various points in occupied habitat and relative fish densities at those measured points; study subjects need not be endangered or threatened species; more common species may be apt study subjects.

Recommendation #18: The County should consider a requirement for a periodic assessment of Starhead Topminnow and Weed Shiner populations, at least once per decade, with a report to County officials and the IDNR of apparent population trends and possible explanations for the results.

Indiana Bat, *Myotis sodalis*, and other Bats. As demonstrated by fatalities of Indiana Bats at an Indiana wind farm in 2009 and 2010, and a Pennsylvania wind farm in 2011, this federally-listed species is vulnerable to collision with utility-scale wind turbines, especially during migration. It appears all bats occurring in Illinois are vulnerable to wind turbine collision.

The US Fish & Wildlife Service considers all of Illinois to lie within the historic range of the Indiana Bat. However, not all counties have records of Indiana Bats within the last thirty years. Until 2011, Bureau County had no records for this species.

The Blackball Mine, near LaSalle-Peru, provides a winter hibernation site for the Indiana Bat, and it is the only "critical habitat" designated by the Fish & Wildlife Service for this species in Illinois. In April 2011, the Department conducted a telemetry study to follow the migratory flights of gravid female Indiana Bats as they emerged from hibernation in the Blackball Mine. The majority of bats entered the forests along the Illinois River and, after foraging for a few hours or days, moved downstream along the River in the direction of Peoria. A number of these bats selected maternity roost trees in Bureau County, in close association with the Illinois River and its tributary creeks, streams, and backwaters. However, none were tracked up the Hennepin Canal and all remained in eastern Bureau County, approximately 20 miles southeast of the project area.

Mainstream Power commissioned a thorough study of bats using the project area, employing both acoustic monitoring and mist-netting. No Indiana Bats were captured.

Consequently, it is the opinion of the Department the proposed project is unlikely to adversely affect the essential habitat of the Indiana Bat, and is unlikely to lie on a migration route for this species.

Acoustic monitoring and mist-netting are useful in identifying the entire local bat community which may be affected by a wind farm. Bats still considered common in Illinois have proven highly-susceptible to White-Nose Syndrome, a "new" disease currently devastating bat populations in more eastern states. The Fish & Wildlife Service is now evaluating petitions to list the **Little Brown Bat** (*Myotis lucifugus*) and the **Northern Long-eared Bat** (*Myotis septentrionalis*). The **Big Brown Bat** (*Eptesicus fuscus*) and the **Tricolor Bat** (*Perimyotis subflavus*) are also susceptible. All four are present within and adjacent to the project footprint. Those planning wind turbines should anticipate that one or more of these additional bat species may become listed in Illinois within the useful lifespan of the wind turbine.

The average mortality of bats at Illinois wind turbines averages about four bats per turbine per year, but some facilities have reported much higher levels of 16 bats per turbine per year, and even 30 bats per turbine per year. Because of the uncertainties facing bat populations in Illinois, it would be prudent to conduct at least one year of post-construction monitoring of bat mortality to be better prepared to address future regulatory actions.

Recommendation #19: The County should consider a requirement the developer conduct at least one season of post-construction mortality monitoring to assess or quantify the levels of bat mortality within the project area.

Bald Eagle, *Haliaeetus leucocephalus*, and Golden Eagle, *Aquila chrysaetos*. Though no longer listed as endangered or threatened, eagles are still specifically protected by the federal *Bald and Golden Eagle Protection Act*.

Illinois is experiencing a strongly-resurgent Bald Eagle population. The nearest known nests are on the Hennepin Canal near Tiskilwa and along the Rock River. These locations are well-beyond the expected foraging ranges of this species, although migrating Bald Eagles can be occasionally seen in the area. (A mature adult was observed during the spring bird survey.) But many new nests are observed every year, some in unexpected areas. The Green River may offer habitat in some locations. In any case, the Bald Eagle is not particularly vulnerable to wind turbine collisions; these are extremely rare, even where Bald Eagles are numerous. However, if Bald Eagles are frequently observed in the vicinity, it would be prudent for the developer to consult the Fish & Wildlife Service.

The Golden Eagle, however, is very vulnerable to wind turbine collisions. While this species is not currently known to breed in Illinois, winter brings northern populations southward. It is not uncommon for this species to be observed along the Rock River, and a famous instance of an observed attempted predation of an adult white-tailed deer occurred at Nachusa Grassland two years ago. This winter, Golden Eagles have been reported along the Mississippi River as far south as St. Louis. Golden Eagle populations are also expanding, which may lead to further enlargement of its winter range. Any observation of a Golden Eagle in the vicinity of the project should be cause for concern, and consultation with the Fish & Wildlife Service is recommended.

Regal Fritillary Butterfly, *Speyeria idalia*. This grassland butterfly has an unusual life cycle and specific relationships with particular plants. Recent records have been established in several

locations in Lee County (at both Foley Sand Prairie and Ryan Sand Prairie, within and adjacent to the project footprint there), in Whiteside County (at Wahl/Garman Prairie), and in Bureau County (at McCune Sand Prairie, about eight miles southwest of the project footprint).

People tend to think of butterflies in their adult life-stage, when they are most noticeable and recognizable, but where this species reproduces, it is present all year long. However, eggs and larvae (caterpillars) are considerably harder to spot. The literature on this species often mentions a specific host-relationship with the **Bird's-foot Violet**, *Viola pedata*, but the caterpillars have been documented feeding on at least eight species of Violets, so the absence of Bird's-foot Violet is not a reliable indicator of the Regal Fritillary's absence. Moreover, only violets growing in the context of prairie vegetation will support reproduction of this species, even if they are not a preferred variety.

Adult Regals are strong fliers and have been documented more than 20 miles from their reproductive sites. Females are also prolific--but indiscriminate--egg-layers, producing up to 10,000 eggs each, but with no discrimination on which plants eggs are placed or in what context those plants occur. Eggs hatch in the fall, and the new larvae fall to the ground, where they overwinter in vegetative litter. In the spring, the larvae must quickly find a suitable violet in order to feed, or perish.

The species is dimorphic, with the sexes being distinguishable by wind markings. Males emerge from metamorphosis first, in about mid-June, with females emerging about two weeks later. Only 10-15 days are available for mating, however, before the males die. Females must then survive until mid-September, when egg-laying begins. Adults survive on nectar and must have access to flowering plants to do so. Hence, prairie remnants depauperate in flowering forbs between June and October offer poor habitat and can force adults to wander.

Although this species has been observed at heights approaching 100 feet, it generally flies much lower, so that wind turbine collision is not a major threat. Fires ("controlled" or otherwise), predation, and vehicle collisions cause much mortality, as do "collectors" unaware of the status of this rare and beautiful insect. Eggs and larvae can also be devoured by mice and voles; they may be crushed by livestock, vehicle tires, and even foot-traffic; and, like any butterfly, they are vulnerable to vehicle collisions along roads, where many nectaring plants exist..

The Department is aware of no studies addressing the responses of insects like the Regal Fritillary to shadow-flicker, but this could be a factor with some effect.

Mainstream Power assessed potential habitat for this species in the project area and concluded the species is most likely to be encountered on state-owned properties which receive natural-area management. The Department does not disagree with this assessment, but is aware that some privately-owned parcels exist with populations. However, it is always possible adults may be encountered far afield from the point of origin, and are capable of establishing new reproductive sites in favorable habitat. Small areas of potentially suitable habitat are present in the project footprint in Bureau County.

Recommendation #20: The County should consider a requirement that all contractors and employees working on the project should be trained to recognize the Regal Fritillary Butterfly, both as a caterpillar and as an adult; to understand its significance to the project and the public; and be instructed how to respond to an observation or encounter with this species.

Recommendation #21: The County should consider a requirement that all sightings of possible or actual Regal Fritillaries be reported to the County and to IDNR.

Recommendation #22: Where the Regal Fritillary is present, during the construction phase project vehicles should reduce speed to minimize the risks of taking butterflies through collision, or find an alternate route with less risk.

Northern Harrier, *Circus cyaneus*. The Northern Harrier (also called the Marsh Hawk) is a migratory grassland bird. Nearly all pre-construction bird surveys for Illinois wind farms have reported this species in spring and fall migrations but, to date, the Harrier is almost universally absent from post-construction surveys.

Evidence continues to accrue that this species, more than others, actively avoids the vicinity of wind turbines. This not only renders otherwise suitable breeding and hunting habitat within a wind farm untenable; it may create a "barrier effect" when wind farms are spaced closely together, so that migratory patterns are disrupted.

In this case, the Green River Wind Farm will fall in the middle of a nearly-unbroken line of existing and proposed wind farms stretching more than 100 miles from DeKalb to Alexis in Mercer County. While the erection of such a barrier is not the sole responsibility of any single developer or county government, all should be aware of their contributions to a regional adverse impact to this endangered species.

Recommendation #23: The County should consider a requirement for post-construction migratory bird surveys, with a special emphasis on the presence or absence of the Northern Harrier.

Loggerhead Shrike, *Lanius ludovicianus*, and Short-Eared Owl, *Asio flammeus*. Neither of these listed species has been reported as breeding within the Bureau County portion of the project area, but records do exist of Shrikes breeding in the larger project area within the last decade. Neither species was observed during Mainstream's breeding bird survey effort.

The Shrike nests in shrubs and small trees in open woodlots near open grasslands. It feeds primarily on large insects, like grass-hoppers and cicadas, and small rodents, such as mice and voles. Sometimes called the Butcher Bird, it often impales its prey on large thorns or twigs for several days, which aids in its dismemberment. Originally listed as "threatened," its continued decline resulted in a new status of "endangered" in 2009. Shifting agricultural practices which have eliminated many fencerows and windbreaks have been detrimental.

The Shrike is not known to be particularly vulnerable to turbine collisions, though some have been reported in western states. There is a greater potential for inadvertent nest destruction if

trees are removed to improve transportation access or to reduce wind turbulence. Shadow-flicker could also be a factor of concern. If suitable habitat is present, there is always a chance a breeding pair will take up residence. Habitat need not be in a large block; railroads and roadsides sometimes are sufficient for breeding or wintering success, and nesting attempts at human homesteads have been reported.

The Short-Eared Owl is a prairie ground nester. Though primarily nocturnal, it often becomes active several hours before sunset. Small rodents are its primary prey, although snakes and other animals are sometimes taken. This species has nested successfully at Sand Prairie State Natural Area in Lee County. This species does migrate, but with an adequate prey base, can over-winter in the same habitat; owls observed in the winter are usually not the same owls present in the summer.

While it does have natural enemies, vehicle collision is a major source of mortality, since most flights are seldom higher than ten feet above ground and roadside habitats may provide the best local hunting areas.

The Short-Eared Owl hunts as much by sound as by sight, so that turbine noise may hamper feeding forays, while shadow-flicker may be stressful. These factors may also alter or affect prey abundance. The Department is not aware of any research investigating the response of this species to wind turbines.

Recommendation #23: The County should consider a requirement that all contractors and employees working on the project should be trained to recognize the Loggerhead Shrike and Short-Eared Owl, to understand their significance to the project and the public, and be instructed how to respond to an observation or encounter with these species.

Recommendation #24: The County should consider a requirement that all sightings of Shrikes and Short-Eared Owls be reported to the County and to IDNR.

Other Landscape Features. No dedicated Illinois Nature Preserves, registered Land & Water Reserves, designated Illinois Natural Areas Inventory Sites, or IDNR-owned or IDNR-managed properties exist with the Bureau County portion of the footprint. However, this portion of the project will be visible from a large number of such parcels.

Among these will be **Johnson-Sauk Trail State Park** in Henry County (18 miles); **Mautino State Fish & Wildlife Area** in Bureau County (14 miles); **Mineral Marsh State Natural Area and Nature Preserve** in Henry County (12 Miles); the **Hennepin Canal** in Bureau County (3 miles); **Sand Prairie State Habitat Area** in Lee County (3 miles); **Foley Sand Prairie Nature Preserve** in Lee County (4 miles); and the **Green River State Fish & Wildlife Area** in Lee County (6 miles).

The Whiteside and Lee County Portions of this project will be much closer to those properties in Lee County, and other existing, permitted, or proposed wind farms in Lee, Bureau, and Henry Counties are already visible or will be more prominently visible when built.

Wind farms are most visible at night due to required FAA aviation warning lights, which can draw nocturnal migratory birds into danger of collision with rotating turbine blades. However, the FAA has recently approved several Audio-Visual Warning Systems (AVWS) which allow warning lights to remain off unless and until an aircraft is approaching at an altitude and bearing which places it in danger, then shuts them off when the danger has passed. Such a system would benefit nocturnal migrating birds and other nocturnal wildlife and limit the obtrusiveness of wind turbines to important natural and recreational areas.

Consultation on the part of the Department is terminated, unless Bureau County desires additional information or advice related to this proposal. In accordance with 17 Ill. Adm. Code 1075.40(h), the County must notify the Department of its decision regarding these recommendations, whether it will:

- Proceed with the action as originally proposed;
- Require the action to be modified per Department recommendations (please specify which measures if not all will be required); or
- Forgo the action.

This consultation is valid for two years unless new information becomes available which was not previously considered; the proposed action is modified; or additional species, essential habitats, or Natural Areas are identified in the vicinity. If the project has not been implemented within two years of the date of this letter, or any of the above listed conditions develop, a new consultation is necessary.

The natural resource review reflects the information existing in the Illinois Natural Heritage Database at the time of the project submittal, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, the applicant must comply with the applicable statutes and regulations. Also, note that termination does not imply IDNR's authorization or endorsement of the proposed action. Please contact me if you have questions regarding this review.

Sincerely,

Keith M. Shank
Impact Assessment Section
Division of Ecosystems and Environment
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cc: Jenny Skufca, Illinois Nature Preserves Commission
John Martin, Mainstream Power USA